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## Description

The present invention relates to a system for regulating the feed of articles to a wrapping machine, of the type comprising:

— conveyor means for feeding a series of longitudinally spaced articles to the wrapping machine; such conveyor means including a first accumulation belt conveyor on which the articles are accumulated in an aligned condition, and a second spacing belt conveyor which receives the articles from the first accumulation belt conveyor and feeds such articles to the wrapping machine, said second belt conveyor having a speed greater than that of said first belt conveyor so as to cause the spacing of the articles from each other,

— sensor means for detecting the position of each article on said second spacing belt conveyor, irrespective of the position of the latter,

— control means for varying the speed of said second belt conveyor in dependence on output signals from the sensor means so that the articles are fed to the wrapping machine in a predetermined phase relationship therewith.

A regulating system of the type specified above has been proposed in Italian Patent Application No. 67656/79 (corresponding to GB-A-2 045 712) by the same Applicants. In this known system, the sensor means are arranged to detect whether, at the instant at which they are actuated, a given article is ahead or behind its correct position in phase with the wrapping machine. The conveyor means are driven by the control means with two different speeds which are selected in dependence on the output signals from the sensor means. Thus, any advance or delay deviation of a given article may be corrected so as to feed this article substantially in phase with the wrapping machine.

The object of the present invention is to improve this known system by increasing the precision with which the articles are maintained in their correct positions, that is, in phase with the wrapping machine.

In particular, it would be desirable to have sensor means capable to detect the degree of any deviation of each article from its correct position in phase with the wrapping machine, so as to have the possibility to correct the speed of the second spacing belt conveyor in proportion to the degree of deviation detected.

A system for feeding articles to a machine wherein the speed of the feeding means is corrected in proportion to the degree of deviation of each article from its proper position is known from EP-A-19 718.

However, this prior reference relates to an apparatus for applying indicia (e.g. labels) to generally cylindrical articles, such as bottles or cans, wherein the articles are spaced on a feeding conveyor by means of a rotating screw, whereby the position of each article on the feeding conveyor is unequivocally defined by the angular position of the screw. Due to this particular arrangement, the position of the articles on the

feeding conveyor can be detected by simply checking the angular position of the screw.

Such known arrangement may not surely be adopted in case of articles such as confectionary products like candy bars and the like, for which conveyor means having the structure indicated at the beginning of this description must be used in order to prevent damage of the articles. In this latter case it is then necessary to provide sensor means capable to detect the position of the articles on the feeding conveyor means irrespective of the position of the latter.

In order to achieve the above mentioned object, the invention provides a system of the type indicated at the beginning of this description, characterised in that the sensor means are arranged to provide a combination of on/off signals which contains the information on the degree of any deviation of each article from the correct position in phase with the wrapping machine, and in that the control means are arranged to correct the speed of the second spacing belt conveyor in proportion to the degree of deviation detected.

In a first embodiment, the sensor means are constituted by a single sensor device which is actuated several times in correspondence with the passage of each article.

In a second embodiment, the sensor means are constituted by a series of sensor devices which are longitudinally aligned and are actuated simultaneously in correspondence with the passage of each article.

In a third embodiment, the sensor means are constituted by a series of longitudinally aligned sensor devices which are actuated several times, each time simultaneously, in correspondence with the passage of each article.

According to a further preferred characteristic, different longitudinally spaced sensor means are provided so as to allow the detection of the deviation to be repeated one or more times on a single article in the course of its movement. By virtue of this characteristic, it is possible to check the result of a previously performed correction and possibly improve its precision.

Further characteristics and advantages of the present invention will emerge from the description which follows with reference to the appended drawings, provided purely by way of non-limiting example, in which:

Figure 1 is a schematic side elevational view of a system according to the present invention, and

Figures 2 to 5 illustrate the principle of operation of the system of Figure 1.

In the drawings, reference numeral 1 generally indicates conveyor means arranged to feed a series of longitudinally spaced articles 2 to a wrapping machine 3 (indicated schematically in Figure 1) provided at its input end with a conveyor device 4. This device comprises a series of blades 5 each of which thrusts a respective article 2 towards the wrapping machine.

The system according to the present invention is able to feed the articles 2 successively in a

predetermined phase relationship with respect to the conveyor device 4 so as to make each article come into precise engagement with the respective blade.

It should be observed, however, that the system according to the present invention is usable in general for "phasing" articles relative to a wrapping machine irrespective of whether the member of the wrapping machine with respect to which the articles are "phased" is a bladed conveyor of the type illustrated in Figure 1 or any other type of element.

The conveyor means 1 include a conveyor belt 6 on which accumulate the articles arriving from a conveyor line disposed upstream (not illustrated), and a conveyor belt 7 which moves at a velocity greater than that of the belt 6, so as to achieve longitudinal spacing of the articles from each other, and has a length such that there is never more than one article present thereon.

Sensor means 8 are associated with the conveyor belt 7 and, in the example illustrated, are constituted by four photoelectric cells 9 to 12 the actuation of which is effected through control means 13 by the said conveyor device 4, as indicated schematically by line 14. This may be achieved in any known manner (see, for example, Italian Patent Application 29219/72 = GB-A-1 412 679). The expression "actuation of the sensor means" refers both to the case of true actuation and to the case in which the cells 9 to 12 are in fact always active, thus "actuation" consisting of making a comparison between the output signal from the cells and a predetermined threshold signal.

Since the actuation of the sensor means 8 is effected by the conveyor device 4, the instants at which these sensor means are actuated correspond to predetermined positions of the conveyor device 4. It follows that the sensor means 8 are arranged to detect whether at a predetermined instant a given article is in the correct position, that is, in phase with the conveyor device 4.

Assuming, for example, that the position in which a given article 10 should be at the instant of actuation of the sensor means 8, to be correctly in phase with the conveyor device 4, is that illustrated in Figure 2 then, under these conditions, the photoelectric cells 9, 10 would be obscured, while the photoelectric cells 11, 12 would be clear. Whenever the article 2, at the instant of actuation of the photocells, is in the position illustrated in Figure 3, the photocells 9, 10, 11 are obscured and only the photocell 12 is clear. This indicates that the article is slightly ahead. If then, at the instant of actuation, all the photocells 9 to 12 are obscured (Figure 4), this indicates that the article 2 is even more in advance. Similarly, the fact that the cell 10, and possibly the cell 9, are clear at the instant of actuation, indicates that the article 2 is behind, the degree of delay being greater when both the cells 9, 10 are clear.

From what is stated above, it is clear that the output signals from the sensor means 8 are indicative not only of the direction of any deviation

of a given article from the correct position but also of the degree of this deviation.

The control means 13 receive the output signals from the sensor means 8 and actuate a motor 15 which drives the conveyor belt 7, varying the speed so as to correct the said deviation.

According to the invention, the control means 13 are arranged to correct the speed in proportion to the degree of deviation detected by the sensor means 8.

By virtue of this characteristic, the system according to the invention guarantees precise "phasing" of the articles.

Naturally, the degree of precision may be increased by increasing the number of sensors, so as to enable a higher number of differentiated levels of advance or delay of the article relative to its correct position to be detected.

In a variant, the sensor means 8 are constituted by a single photoelectric cell 16 which is actuated several times in correspondence with the passage of a single article.

With reference to Figure 5, assuming, for example, that the photoelectric cell 16 is actuated five times in succession in correspondence with the passage of each article, then Figure 5 illustrates the positions in which the article 2 must be at each instant of actuation to be correctly in phase with the conveyor device 4. As is seen, in the case of this example, if the article 2 is in its correct position, the photoelectric cell 16 must be clear at the instants of the first two actuations A and B, must be obscured at the instant of the third C and must be clear again at the instants of the final two actuations D and E. If the article 2 is ahead of the correct position, the photoelectric cell 16 is already obscured at the instant of the second actuation B, and if the degree of advance is considerable the cell 16 is already obscured at the instant of the first actuation A. Similarly, if the article is delayed, the photoelectric cell 16 may again be obscured at the instant of the fourth actuation D and possibly (a greater delay) at the instant of the final actuation E. Hence, the series of output signals emitted by the photoelectric cell 16 in correspondence with the passage of each article 2 is indicative not only of the direction of any deviation of the article with respect to its correct position, but also the degree of this deviation. Again in this case, the control means 13 are arranged to effect a correction of the speed, which is proportional to the degree of deviation detected. The precision of the correction may be increased by increasing the number of actuations of the photocell 16 in correspondence with the passage of each article so as to enable the detection of a higher number of differentiated levels of advance or delay of the article with respect to its correct position.

Naturally, it is possible to provide a system constituted by a combination of the two variants described above. Thus, it is possible to provide a series of longitudinally aligned sensors of the photoelectric cell type 9 to 12 illustrated in Figure 1, and to actuate the sensors several times, each

time simultaneously, in correspondence with the passage of each article, in accordance with the example illustrated with reference to Figure 5. This allows the number of differentiated levels of advance or delay detectable by the sensor means to be increased further.

In a further variant (not illustrated), several conveyors of the conveyor type 7 are provided which are located downstream of one another and are each provided with sensor means of the same type as the sensor means 8 to allow the detection of any deviation from the correct position to be repeated several times on a single article in the course of its movement, so as to check the result of previously effected corrections and possibly to improve its precision.

#### Claims

1. System for regulating the feed of articles to a wrapping machine, comprising:

— conveyor means (1) for feeding a series of longitudinally spaced articles (2) to the wrapping machine (3); such conveyor means (1) including a first accumulation belt conveyor (6) on which the articles are accumulated in an aligned condition, and a second spacing belt conveyor (7) which receives the articles from the first accumulation belt conveyor (6) and feeds such articles to the wrapping machine, said second belt conveyor (7) having a speed greater than that of said first belt conveyor (6) so as to cause the spacing of the articles from each other,

— sensor means (8) for detecting the position of each article on said second spacing belt conveyor (7), irrespective of the position of the latter,

— control means (13) for varying the speed of said second spacing belt conveyor (7) in dependence on output signals from the sensor means (8) so that the articles (2) are fed to the wrapping machine (3) in a predetermined phase relationship therewith,

characterised in that the sensor means (8) are arranged to provide a combination of on/off signals which contains the information on the degree of any deviation of each article (2) from the correct position in phase with the wrapping machine, and in that the control means (13) are arranged to correct the speed of the second spacing belt conveyor (7) in proportion to the degree of deviation detected.

2. System according to Claim 1, characterised in that the said sensor means (8) are constituted by a single sensor device (16) which is actuated several times in correspondence with the passage of each article (2).

3. System according to Claim 1, characterised in that the sensor means (8) are constituted by a series of sensor devices (9 to 12) which are longitudinally aligned and are actuated simultaneously in correspondence with the passage of each article.

4. System according to Claim 1, characterised in that the sensor means (8) are constituted by a longitudinally aligned series of sensor devices (9

to 12) which are actuated several times, each time simultaneously in correspondence with the passage of each article.

5. System according to Claim 1, characterised in that it includes several sensor means spaced longitudinally from each other to allow the detection of any deviation from the correct position in phase with the wrapping machine several times for each article in the course of its movement.

#### Patentansprüche

1. System zum Regeln der Zufuhr von Gegenständen zu einer Verpackungsmaschine, umfassend

— einen Förderer (1) zum Zuführen einer Reihe von in Längsrichtung Abstände aufweisenden Gegenständen (2) zur Verpackungsmaschine (3); der Förderer (1) umfaßt einen ersten Sammel-Band-Förderer (6), auf welchem die Gegenstände ausgerichtet angesammelt werden, einen zweiten Vereinzelungs-Band-Förderer (7), der die Gegenstände vom ersten Sammel-Band-Förderer (6) aufnimmt, zur Verpackungsmaschine fördert und eine Geschwindigkeit hat, die größer als diejenige des ersten Band-Förderers (6) ist, um hierdurch das Vereinzeln der Gegenstände zu erreichen;

— einen Sensor (8) zum Erfassen der Position eines jeden Gegenstandes auf den zweiten Vereinzelungs-Band-Förderer (7), ungeachtet von dessen Position;

— eine Regeleinrichtung (13) zum Verändern der Geschwindigkeit des zweiten Vereinzelungs-Band-Förderers (7), abhängig von Ausgangssignalen aus dem Sensor (8), so daß die Gegenstände (2) der Verpackungsmaschine (3) in einem vorbestimmten Phasenverhältnis hiermit zugeführt werden,

dadurch gekennzeichnet, daß der Sensor (8) derart ausgelegt ist, daß er eine Kombination von Ein-Aus-Signalen erzeugt, die die Information über das Maß der Abweichung eines jeden Gegenstandes (2) von der richtigen, in Phase mit der Verpackungsmaschine befindlichen Position enthält, und daß die Regeleinrichtung (13) weiterhin derart ausgelegt ist, daß sie die Drehzahl des zweiten Vereinzelungs-Band-Förderers (7) proportional zum Maß der erfaßten Abweichung korrigiert.

2. System nach Anspruch 1, dadurch gekennzeichnet, daß der Sensor (8) aus einer einzigen Sensorvorrichtung (16) besteht, die in Abhängigkeit vom Durchgang eines jeden Gegenstandes (2) mehrmals betätigt wird.

3. System nach Anspruch 1, dadurch gekennzeichnet, daß der Sensor (8) aus einer Anzahl von Sensor-Vorrichtungen (9—12) besteht, die in Längsrichtung angeordnet und gleichzeitig in Abhängigkeit mit dem Durchlauf eines jeden Gegenstandes betätigt werden.

4. System nach Anspruch 1, dadurch gekennzeichnet, daß der Sensor (8) aus einer in Längsrichtung angeordneten Reihe von Sensor-Vorrichtungen (9—12) besteht, die jeweils,

gleichzeitig in Abhängigkeit vom Durchlauf eines jeden Gegenstandes mehrmals betätigt werden.

5. System nach Anspruch 1, dadurch gekennzeichnet, daß es mehrere Sensoren umfaßt, die in Längsrichtung in einem Abstand angeordnet sind, um das Erfassen einer jeglichen Abweichung von der richtigen Position in Phase mit der Verpackungsmaschine zu erlauben, und zwar mehrmals für jeden Gegenstand im Verlaufe seiner Bewegung.

#### Revendications

1. Système pour régler l'alimentation d'articles vers une machine d'emballage, du type comprenant:

— des moyens transporteurs (1) pour l'amenée d'une série d'articles (2) espacés longitudinalement à la machine d'emballage (3); ces moyens transporteurs (1) comportant un premier transporteur à courroie d'accumulation (6) sur lequel les articles s'accumulent à l'état d'alignement, et un second transporteur à courroie d'espacement (7) qui reçoit les articles du premier transporteur à courroie d'accumulation (6) et les amène à la machine d'emballage, ledit second transporteur à courroie (7) ayant une vitesse supérieure à celle dudit premier transporteur à courroie (6) de façon à amener les articles à s'espacer les uns des autres;

— des moyens de détection (8) pour détecter l'emplacement de chaque article sur ledit second transporteur à courroie d'espacement, quelle que soit la position de ce dernier,

— des moyens de commande (13) pour faire varier la vitesse dudit second transporteur à courroie en fonction de signaux de sortie provenant des moyens de détection (8) de façon

que les articles arrivent à la machine d'emballage (3) dans une relation de phase prédéterminée avec celle-ci,

caractérisé en ce que les moyens de détection (8) sont agencés pour fournir une combinaison de signaux marche/arrêt que contient les informations sur le degré de décalage éventuel de chaque article (2) par rapport à la bonne position en phase avec la machine d'emballage, et en ce que les moyens de commande (13) sont agencés pour corriger la vitesse du second transporteur à courroie d'espacement (7) en fonction du degré de décalage détecté.

2. Système selon la revendication 1, caractérisé en ce que lesdits moyens de détection (8) sont constitués par un seul dispositif détecteur (16) qui est mis en action plusieurs fois en concordance avec le passage de chaque article (2).

3. Système selon la revendication 1, caractérisé en ce que les moyens de détection (8) sont constitués par une série de dispositifs détecteurs (9 à 12) qui sont alignés longitudinalement et sont mis en action simultanément en concordance avec le passage de chaque article.

4. Système selon la revendication 1, caractérisé en ce que les moyens de détection (8) sont constitués par une série alignée longitudinalement de dispositifs détecteurs (9 à 12) qui sont mis en action plusieurs fois, chaque fois simultanément en concordance avec le passage de chaque article.

5. Système selon la revendication 1, caractérisé en ce qu'il comporte plusieurs moyens de détection espacés longitudinalement les uns des autres pour permettre de déceler un écart éventuel par rapport à la bonne position en phase avec la machine d'emballage plusieurs fois pour chaque article au cours de son mouvement.

